Replacing Shutter Curtains in Screw-Mount Leicas

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You can install new shutter curtains in your screw-mount Leica or similar camera; this article shows you how to do it. I am not a pro but an amateur camera repairer and restorer. I have replaced shutter curtains in a handful of cameras including several Leicas, from the model A through the IIIf, and early Canons. This is not an exhaustive treatise on Leica shutters or their repair but a description of some techniques that I have not seen published elsewhere. You should have at least a fundamental understanding of focal plane shutters and general camera repair techniques, and I assume that you have opened, cleaned, and lubricated the camera that needs the new curtains. The details described here will vary somewhat depending on camera model. The references at the end include several books and articles that I have found helpful.

Shutter curtains can be installed after the drum and rollers have been removed from the camera or with them in place. There are two main advantages to the first approach. First, Leicas are crowded inside, so it's easier to attach the curtains and curtain tapes to parts that are spread out on the bench. Second, removal of these parts allows proper cleaning and lubrication of some of the bearing surfaces that are difficult to reach if disassembly is only partial.

A disadvantage to the out-of-camera method is the increased complexity of the project. In particular, reassembly of the multiple shafts, sometimes with loose bearing balls, in the shutter crate is tricky and can be frustrating. Furthermore, this method relies on very accurate initial positioning of the curtains and curtain tapes on the rotating parts and on precise duplication of the old curtains and tapes. If you are working on a camera with damaged or absent curtains or tapes, this method might be impractical. I have never seen published information on exact dimensions or positioning of these parts (with a couple of minor exceptions that I'll describe later).

The in-camera method described here allows essentially arbitrarily accurate adjustment of the curtains and tapes. The trick is to use small pieces of double-sided tape to bond the ends of the curtains and their tapes to the drum and rollers temporarily. After accurate positioning is obtained, the curtains and curtain tapes are cemented. Then the double-sided tape is removed and

replaced with cement. The photos show a Leica IIIa and a IIIf undergoing curtain replacement.

For this method to be possible, it's necessary to wrap the closing curtain with its lath and tapes around the drum twice after its end is attached to the drum, because the rotation of the drum is limited by shutter gearing. As such, the curtain and its tapes can't be wound completely onto the drum by simply rotating it as would be done with the parts out of the camera. Getting the curtain and lath around the drum in tight quarters is possible if 1) the closing curtain latch shaft and spring and the slow speeds retard rod (if present) are removed from the camera, and 2) the lath is not too long. Condition 1 is easily met. Condition 2 may require grinding a little from the ends of the lath.

Figure 1 gives dimensions representative of curtains and tapes that I have measured; the curtains in this photo were bought ready-made and were used in the IIIf. These dimensions should always work, but they are unlikely to be close enough to those of your old parts to allow direct replacement without adjustment of attachment points on the drum. The curtain width is simply the length of the central closing curtain part of the drum and will vary a little with camera model. I made the curtains and tapes shown in the photos of the IIIa from scratch, cutting curtains and tapes from bulk material. I made the laths from a coping saw blade by grinding off the teeth, cutting to length, and grinding the notches for the tapes. If you make your own curtains, be careful to cut their ends at precise right angles to their edges.

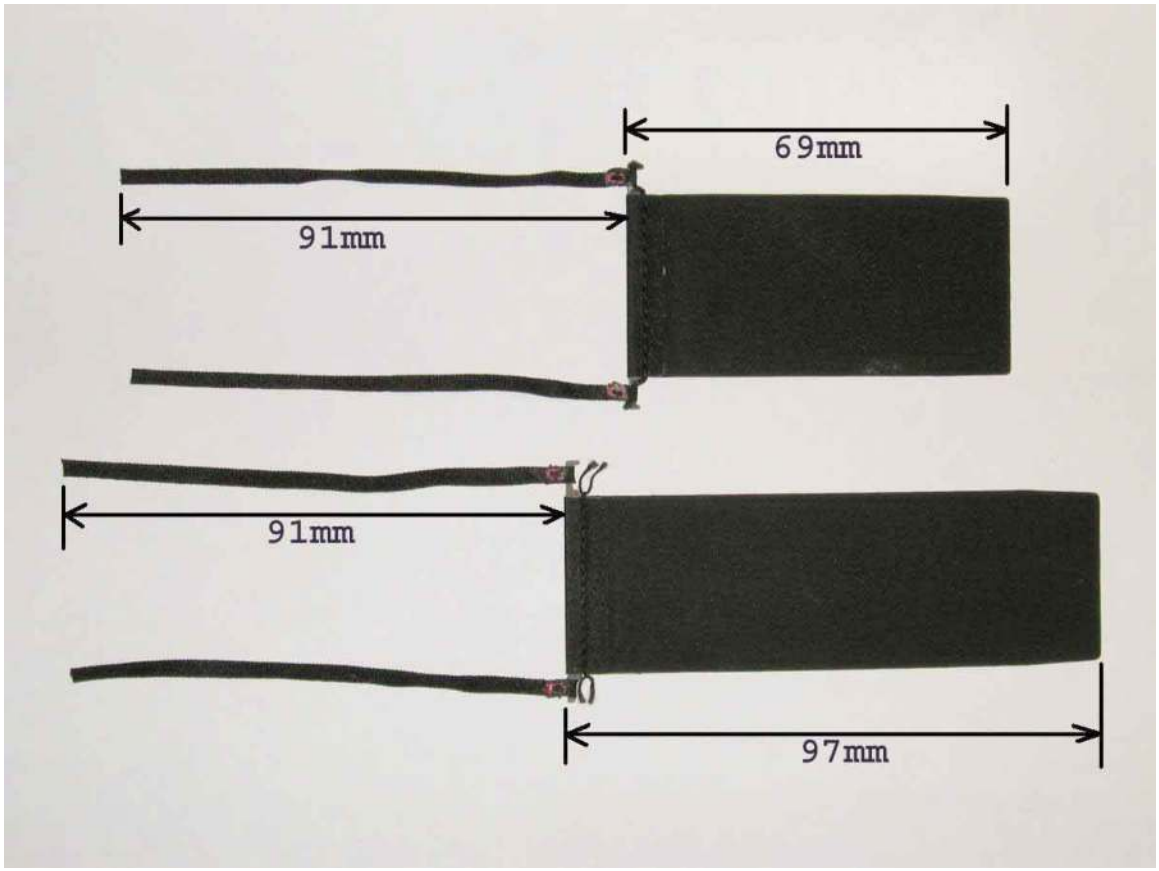

FIGURE 1.

Each curtain is folded around its lath with the rubberized side in, i.e. in contact with the lath. The tapes are folded around the laths in the same sense as the curtains so that the free ends of the tapes are on the opposite side from the free end of the curtain. I have never sewn the curtains onto the laths, instead using cement only, and have never had a failure; my oldest such repair dates from the 70s and is still intact. A drawback of this technique is that the difference from factory curtains is immediately obvious; if you desire exact replication of the factory appearance, either sew the curtains on the laths or buy ready-made parts. In this latter case, if the only parts available are for IIIc and IIIf, you can use them on earlier Leicas and early Canons after a little trimming.

The parts at the bottom of the shutter crate that take place in shutter action should be in place. It's convenient for the wind knob and the winding gear train at the top of the camera to be in place. Remove all baffles and the rangefinder lever. Be sure to thoroughly clean and lubricate the mechanism before installing the curtains.

The closing curtain is installed first. You will need an accurate reference line at or near the point where the end of the curtain will be attached to the drum. This line, a meridian of the cylindrical drum, that is, a line on the

cylinder's surface that is parallel to its axis, will serve as a guide to locate the curtain end precisely parallel to the axis of the drum. There may be an old glue line that can serve as your reference line; if not, scribe a meridian on the drum with a fine marking pen by using the edge of the image aperture as a guide (Figure 2). The drum is held against the stop that limits its rotation after the shutter has been released. Point the pen toward the axis of the drum; this line will then be the approximate location of the attachment of the curtain to the drum.

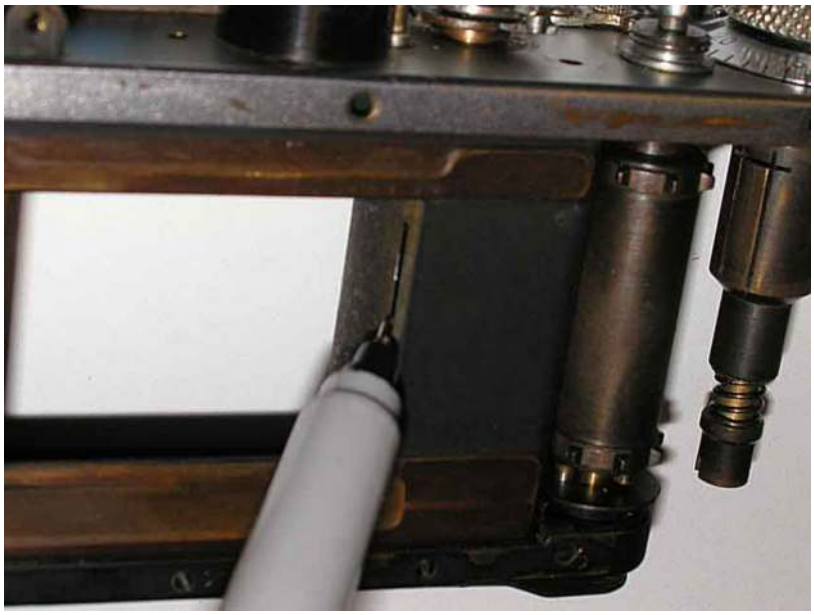

FIGURE 2.

A little to the left (clockwise as viewed looking down on the drum from the top of the camera) of the reference line, stick a length of double-sided tape a little shorter than the width of the curtain and a few millimeters (mm) in width (Figure 3). I use thin plastic carpet tape; cloth carpet tape is too thick. Then peel off the backing from the carpet tape and attach the non-rubberized side of the end of the closing curtain, being careful to keep the edge exactly parallel to your reference line (Figure 4).

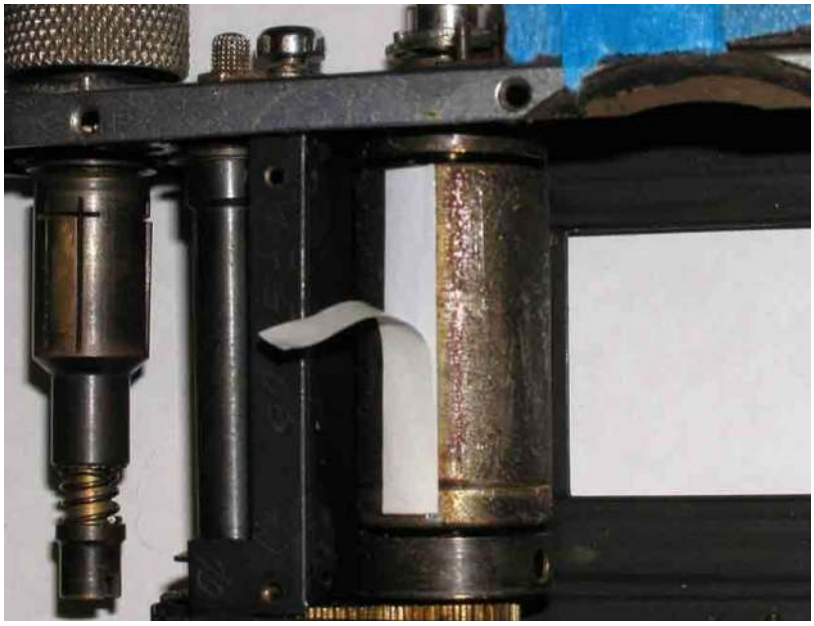

FIGURE 3.

FIGURE 4

Now you must wrap the closing curtain around the drum clockwise. This will require pulling its tapes around the drum to the left and then behind it, and then teasing the lath along the same path. This maneuver is greatly facilitated with a tool made from thin cardboard to which a patch of double-sided tape is applied at one end. You can use a business card cut in half lengthwise. Stick the ends of the closing curtain tapes to the end of the tool and pull them through, followed by the lath and then the curtain (Figures 5 and 6). Then do it again. If the lath refuses to be teased around the drum, it may be too long to fit and require a little shortening with a Dremel or similar hand grinder.

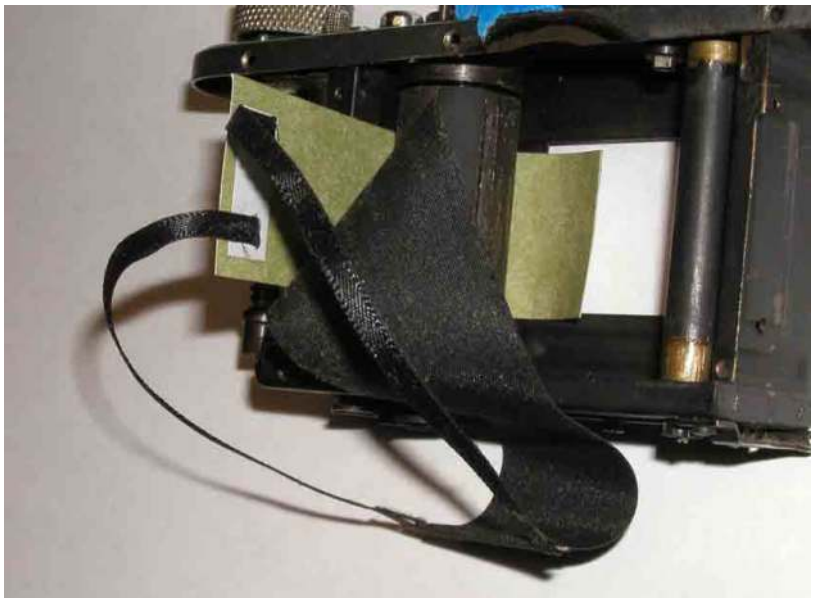

FIGURE 5.

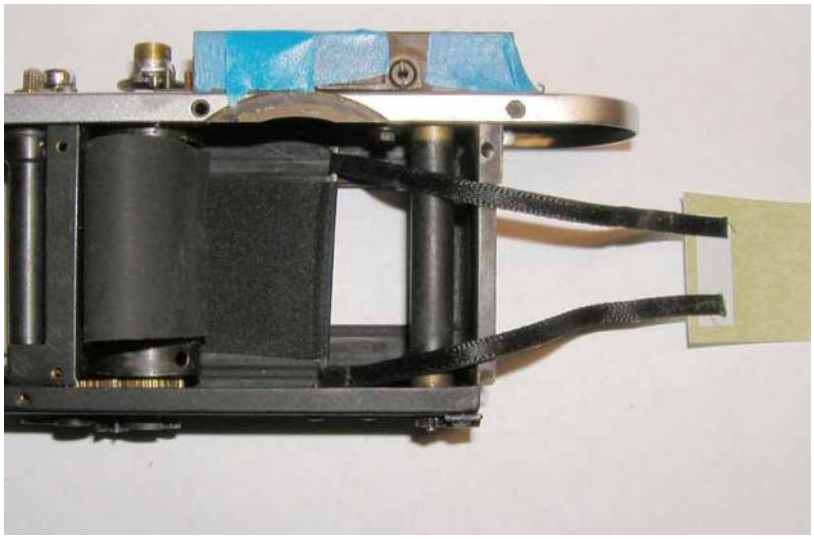

FIGURE 6.

Next, continue the cardboard tool behind the spring rollers and then toward the front of the camera (Figures 7 and 8). Remove the curtain tapes

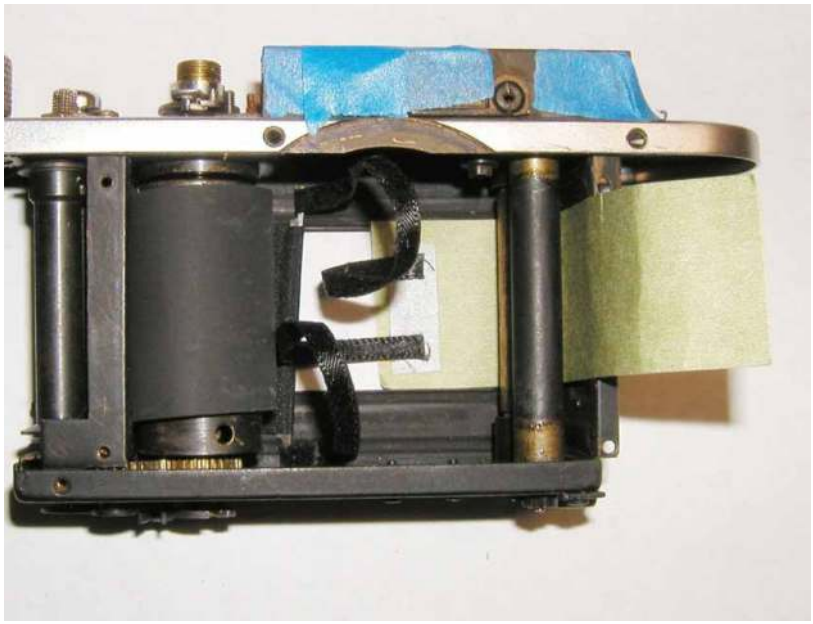

FIGURE 7.

FIGURE 8.

from the tool and attach them to the closing curtain spring roller using small pieces of double-sided tape (Figure 9). The curtain tape ends can be attached anywhere around the circumference of the roller, but (assuming they are the same length) they must be attached on the same meridian so that one tape doesn't pull one edge of the curtain ahead of the other. The positions of the curtain tapes along the axis of the roller should correspond to the positions of the tapes at the lath when it is near the drum with the shutter wound. The edges of the curtain tapes will be near the inner edges of the guide rollers but should not override the edges.

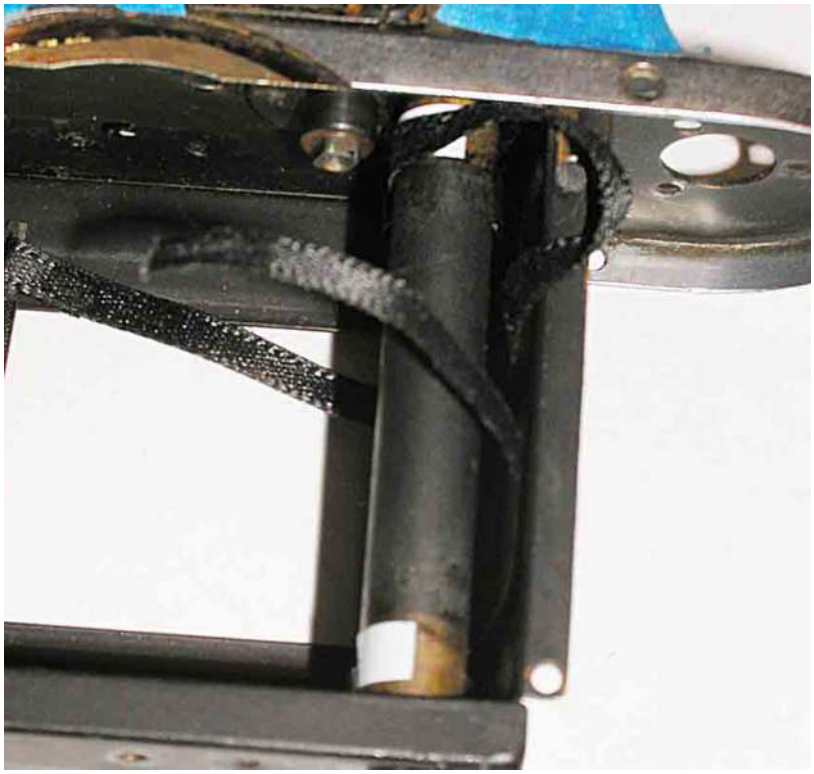

FIGURE 9.

An alternative method of temporarily conveying stiffness to the curtain tapes is shown in Figures 10 and 11. Here Scotch transparent tape is applied to the end of the curtain tape so that it can be pushed behind and around the spring rollers of a IIIf.

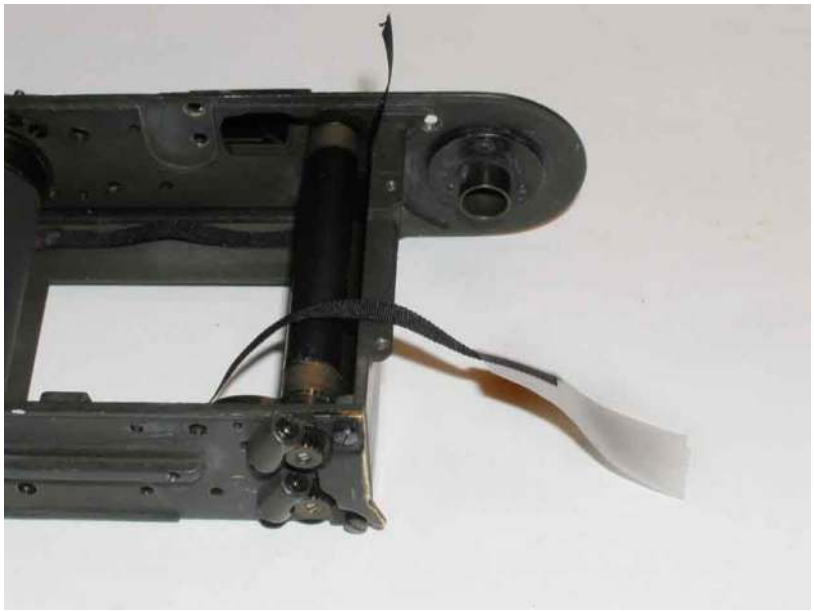

FIGURE 10.

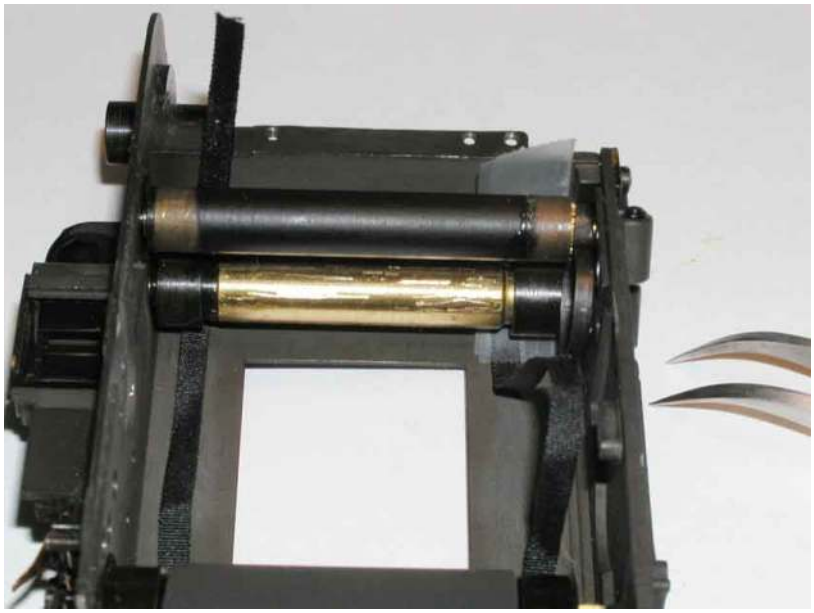

FIGURE 11.

Now you can tense the closing curtain roller spring and test the operation of the curtain. Replace the closing curtain latch shaft and its spring, being careful not to pass the shaft under a loose loop of curtain. From its neutral position, rotate the spring tensing adjustment screw counterclockwise 2 turns to simulate tension in the operating shutter. If you're working on an early camera with tiny lock screws, and the spring lock nuts are not reliably preventing rotation of the shaft, avoid repeated removal and reinstallation of the screws by temporarily locking the spring nut with a toothpick (Figure 12). Wind the advance knob until it stops. Press the shutter release button. The latch will arrest the motion of the curtain as long as the button is held down. The closing curtain should operate normally, except that its attachment point on the drum will likely need adjustment.

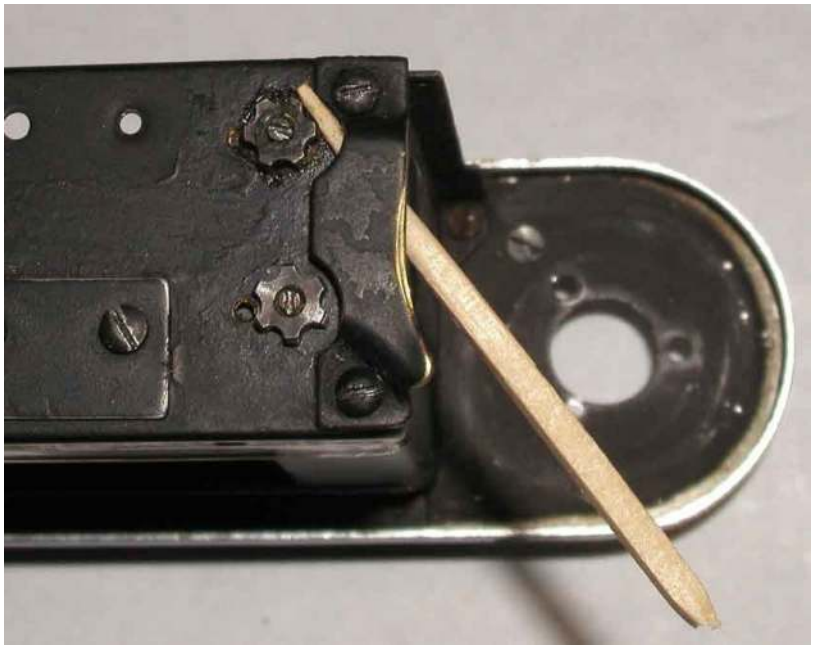

FIGURE 12.

I have not found an official Leitz specification for the position of the curtains relative to the image aperture. However, the Canon manual of the reference list specifies a distance of 3.1 or 3.5mm (depending on camera model) from the edge of the closing curtain to the left edge (as you face the front of the camera) of the image aperture when the closing curtain is held by its latch, ready to be released by the opening curtain cam. I've measured this distance as close to 3mm in several screw-mount Leicas and early Canons in which I believe the shutters are original. If this setback is too short, the closing curtain will encroach on the left side of the image aperture before release, especially at slow speeds. If the setback is too long, the curtains may bounce back into the right side of the image aperture after the shutter has been released.

Make an L-shaped gage in which the short arm of the L projects 3mm beyond the long arm. With the closing curtain retained by its latch (not by the winding mechanism), check the setback as shown in Figure 13. To adjust this setting, you'll need to remove the closing curtain tapes and unwind the curtain and tapes to expose the attachment point. *Don't forget to remove the latch shaft and spring first!* Move the curtain attachment point a distance equal to the difference between the required and actual setbacks. Replace the latch shaft and spring, and tense the roller spring.

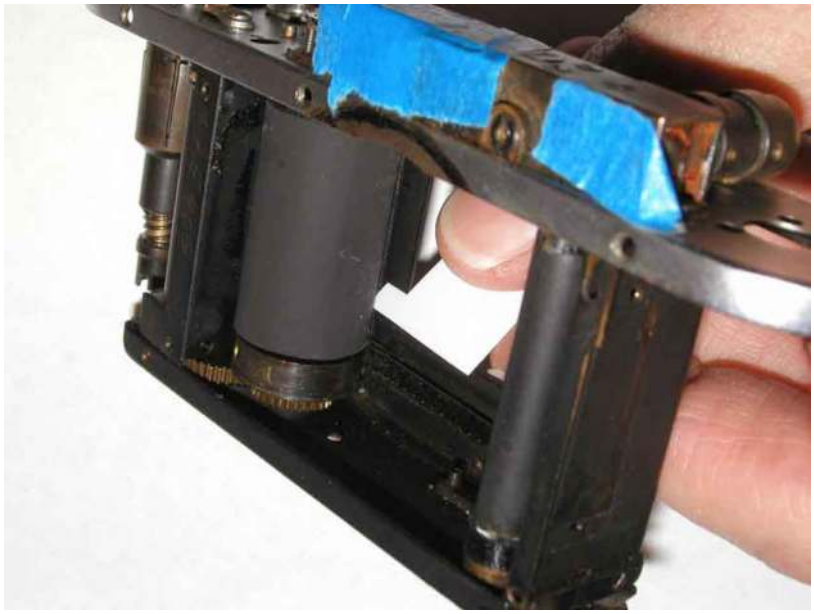

FIGURE 13.

Once the setback is correct, check parallelism between the curtain edge and the edge of the image aperture. Do this by advancing the curtain just beyond the edge of the image aperture and observe the gap (Figure 14). If the edges are not parallel, and the curtain has been cut square and attached parallel to the axis of the drum, it may be that the tapes are not of equal effective length. You can adjust this inequality by moving the tapes' attachment points on the roller by slightly slackening the side that seems to be relatively short or slightly tightening the other side. This method should not be used to compensate for an improperly attached or non-square curtain, in which case you may achieve parallelism, but one side of the curtain will be loose and floppy.

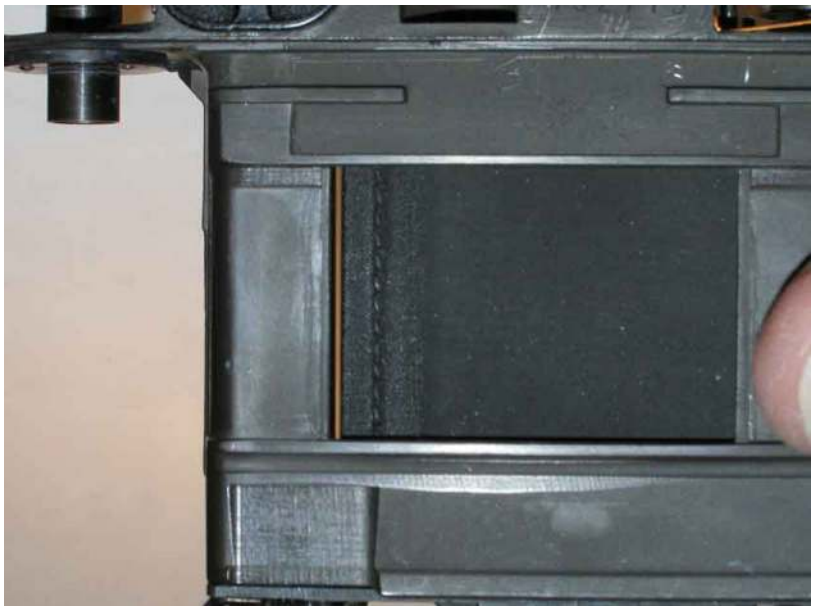

FIGURE 14.

When all is well, the edges of the curtain, the curtain tapes, and the edges of the image aperture will all be parallel. In Figure 15 these conditions are very nearly met; the curtain tapes override the guide rollers very slightly, a condition that I decided to live with. If the curtain tapes try to angle off the horizontal, their positions along the axis of the spring roller may be in error or their effective lengths may be unequal.

FIGURE 15.

Now very carefully mark the attachment points of the closing curtain tapes on the spring roller, relax the spring, and detach the tapes. Remove the latch shaft and spring, and then unwind the curtain one turn from the drum. Starting at the double-sided tape, cement the curtain to the drum. I do this in several stages, allowing the cement to set at each stage (Figure 16). Then remove the double-sided tape and cement this portion of the junction (Figure 17). Next, feed the curtain and tapes around the drum, reattach them to the spring roller, and follow a similar procedure of cementing them. If you've carefully marked their positions and are feeling confident, skip the double-sided tape attachment and go directly to cementing.

FIGURE 16.

FIGURE 17.

Now install the opening curtain and its tapes. The curtain and tapes can be attached in either order; here I describe the attachment of the tapes first. Maneuver the opening curtain tapes and its lath *behind* the closing curtain tapes; in the operating shutter, the closing curtain is *in front of* the opening curtain. A narrow version of the cardboard tool is useful for pulling the tapes around the ends of the drum, as there's less clearance now that the closing curtain is wrapped around central portion of the drum (Figure 18). Or you can use the Scotch tape method.

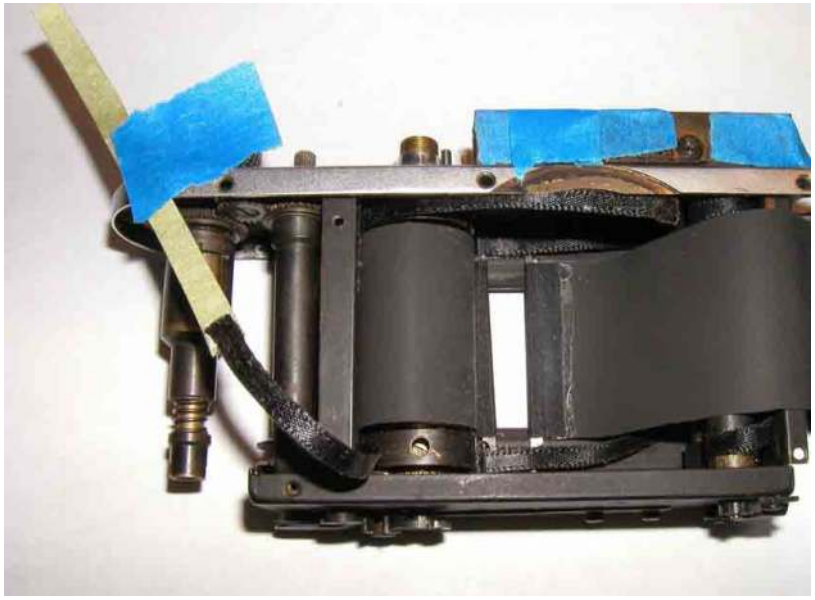

FIGURE 18.

With the drum in the released position, the attachment point of the opening curtain tapes on their drums will be almost out of sight, at about the 2:00 o'clock position as viewed from the top of the camera. These points are usually a few mm in front of (clockwise to) the edge of the closing curtain on its drum when the central and end parts are held in the released clockwise position. There is no way (that I know of) to localize the tape ends precisely on the same meridian, because there's no convenient reference that can be used at both drum ends. For this reason, expect more trial and error in localizing these tapes. Stick on small lengths of double-sided tape on the drum ends as shown in Figure 19, and attach the curtain tapes. Because the ends are difficult to see, place adjacent marks on the opening curtain tapes and their drums at convenient points; these marks will be used later to keep track of changes in the attachment positions. I've found that white correction marker pens work well for placing small marks on the curtain tapes. The arrows in Figure 20 point to a white mark on the lower curtain tape and a nearby tiny scratch on the adjacent drum.

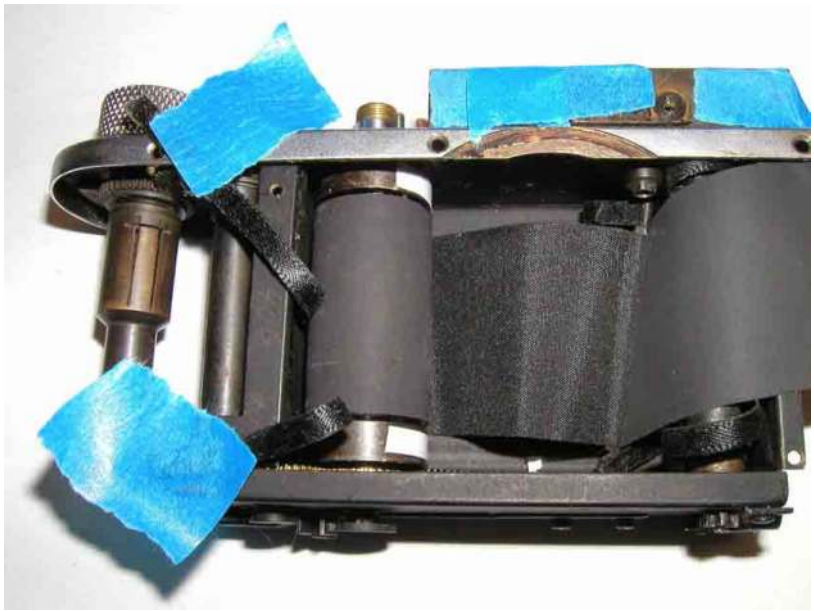

FIGURE 19.

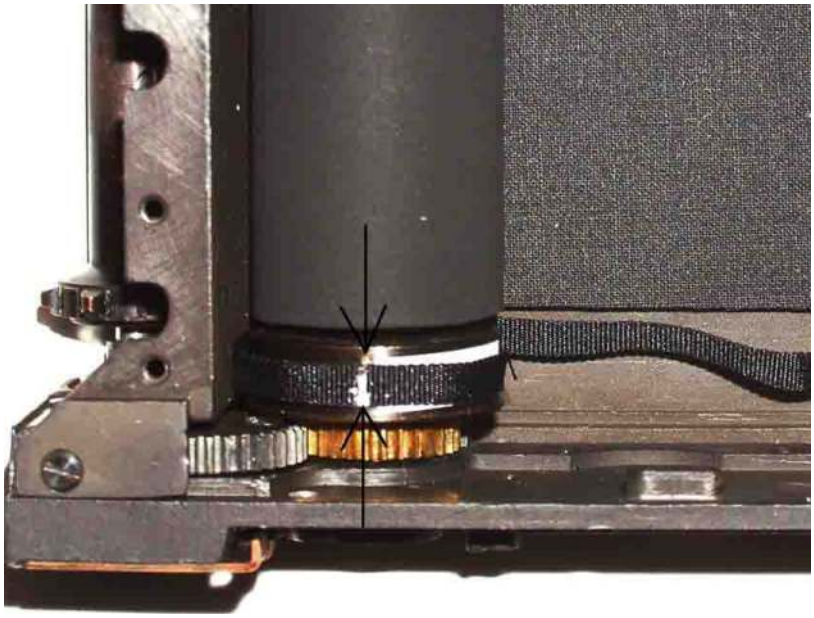

FIGURE 20.

The end of the opening curtain can be attached anywhere around the circumference of the spring roller, but it's critical to achieve parallelism between the end of the curtain and the axis of the roller. If there's no glue line, scribe a meridian line along the surface of the roller as you did on the drum. To keep the roller from rotating during this and following procedures, I temporarily stuff a small piece of dense foam plastic between the roller and the side of the shutter crate. Attach the usual strip of double-sided tape to the roller, and, working from both front and rear of the camera, attach the rubberized side of the opening curtain to the roller; it should be centered between the inner edges of the guide rollers, and its edge should be perfectly parallel to the meridian line. Figure 21 shows the meridian line and double-sided tape on the roller, behind which is the white foam plastic wedge. In Figure 22 the edge of the curtain has been attached.

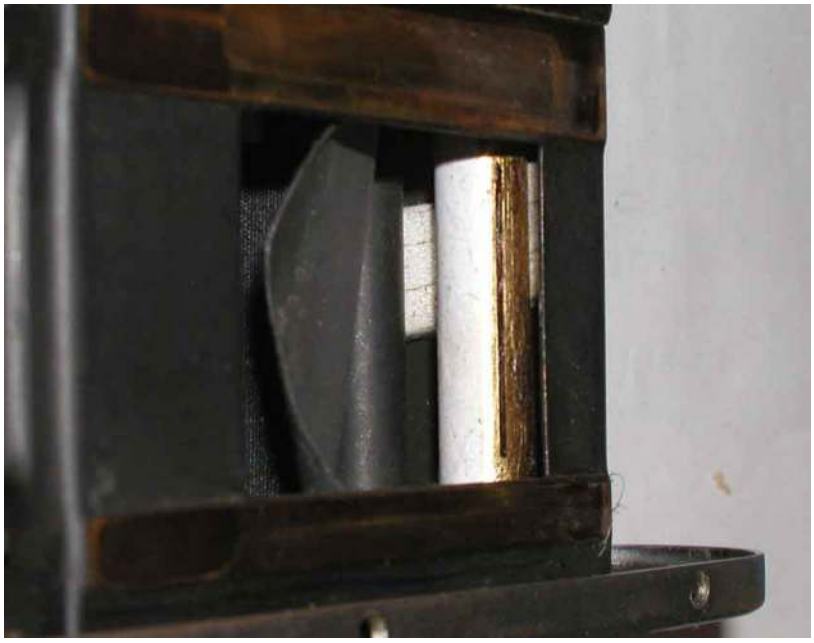

FIGURE 21.

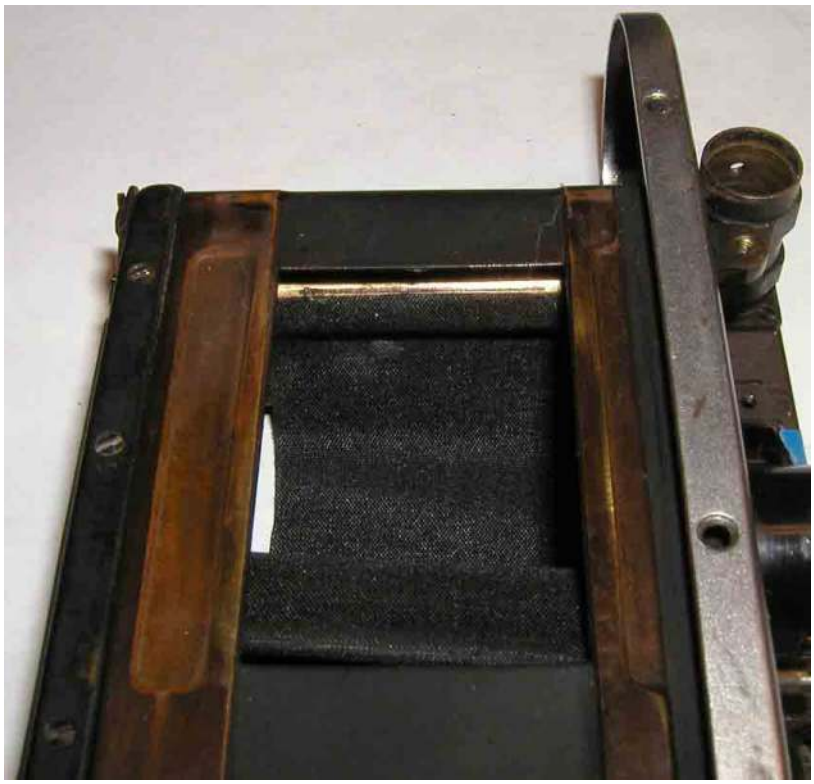

FIGURE 22.

Remove the plastic foam wedge and install the latch shaft and spring. From the neutral points turn the spring adjustment screws clockwise 2 turns on the closing roller and 6 turns on the opening one. These settings are done with the drum in the released clockwise position and the opening curtain and closing tapes wound around their rollers. The shutter should operate at this point, although the opening curtain will no doubt need adjustment. Fortunately, if the curtain was carefully attached to its spring roller, all of the adjustment can be accomplished at the drum. The closing curtain should overlap the opening curtain 3 mm. As with the closing curtain setback, I have not found a Leitz specification for the overlap, although the Canon manual specifies 3 mm; my measurements of presumably original Leica shutters confirm 3 mm in several cameras. (So both the setback and the overlap are 3mm.) Adjust the opening curtain attachment points on the drum for 3 mm overlap.

To check parallelism of the edges of the opening and closing curtains, wind the shutter part way and then turn the closing curtain portion of the drum separately to create a narrow slit (Figure 23).

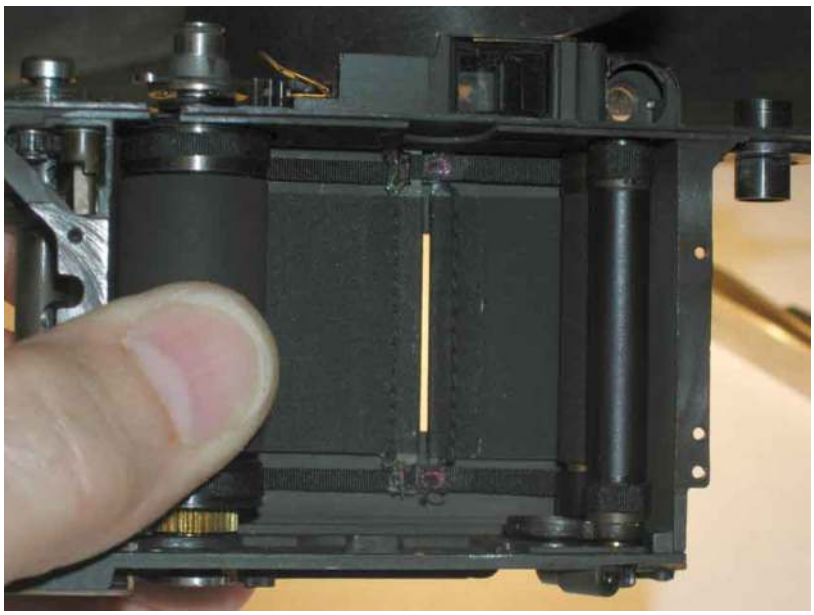

FIGURE 23.

How close to parallel must the edges be? A rough estimate can be made by calculating the width of the slit at the highest shutter speed. For example, in the IIIf of Figure 23 the transit time of the slit for all speeds on the high speed dial is 1/30 second (not all IIIf's are the same in this regard). The slit transit distance is 36mm. At the 1/1000 setting, 1/30 divided by 1/1000 multiplied by 36mm is close to 1mm, the theoretical width of the slit at 1/1000. This means that if the

slit is off parallel by only 1mm, the exposure difference from top to bottom of the image can be very significant. At worst, the slit could be completely closed its narrow end; at best, the slit width would vary from 1mm at its narrow end to 2mm at its wide end, a full 1-stop difference in exposure between top and bottom. For earlier cameras in which the transit time is only 1/20 sec, the slit width is proportionately narrower, increasing the precision requirement still more. In reality the slit widens and accelerates as it traverses the image aperture, so for most of its travel things aren't quite as bad as this calculation would suggest. Nevertheless, the slit width should vary by significantly less than 1mm from top to bottom. When the attachment points of the opening curtain and tapes are satisfactorily located, cement them in stages as for the closing curtain and its tapes. There's room to do this without detaching the opening curtain from its spring roller.

For detailed instructions on shutter adjustment, see Lyells' *The Leica IIIf.* Here's a synopsis of that reference. Attach the shutter speed dial and, if there is one, the flash synch cam, as these parts have rotational inertia that will affect shutter operation. With the shutter in the released position, that is, both laths at the right side of the image aperture, rotate the closing curtain spring adjustment 1 3/4 turns counterclockwise from its neutral position and the opening curtain spring 3 turns. At 1/30 second the shutter may operate with these settings, although more opening curtain tension may be required for reliable release of the closing curtain latch; increase tension 1/2 turn at a time until the closing curtain is released reliably. Now set the shutter at 1/500. Hold the camera with a light behind it, release the shutter, and check for an open slit across the full width of the image aperture. It's likely that none or only part of the left side of the aperture will show light. Continue to increase opening spring tension until you see light across the entire width of the image aperture.

At this point some kind of shutter tester is required. You can use a TV screen if it's an older set with a CRT; flat panel TVs won't work. The TV should be tuned to a station to assure locking of the raster frame rate to the standard frequency. Or make a rotating drum tester from a coffee can, DC motor, and rheostat; see the last entry on the reference list.

Adjust the opening curtain tension in 1/4-turn increments for even exposure across the image aperture at 1/500. Then adjust the 1/500 and 1/1000 eccentric studs on the closing curtain latch for accuracy at these speeds. If you're working on a pre-IIIc Leica, there are no adjusting studs. In this case adjust the opening curtain tension for even exposure across the image aperture at the camera's highest shutter speed and accept the result. The only legitimate way to significantly change the high speeds in these older cameras is to move the attachment points of the opening curtain tapes on the drum; but if the

overlap is correct, and there are no malfunctions, the speeds will be reasonably accurate (but nowhere near as accurate as in modern electronic shutters).

I've found that in pre-IIIc Leicas, Lyells' recommended 1 3/4-turn closing curtain tension often results in transit times faster than the desired 1/20 second. You may want to try less tension in these cameras.

Regarding problems, any source of friction will increase tension requirements and decrease speed accuracy and repeatability. Typical sources are stiff shutter cloth, curtains or tapes dragging on baffles or torn pieces of film, and insufficient cleaning and lubrication. Pre-IIIc Leicas have a small brass shroud that fits around the flanged gear at the lower end of the sprocket roller. If the shroud is bent even a little, it can rub against the gear or the flange. This is the flange that is pushed down by the shutter release shaft or the advance-rewind lever; if it is bent downward even slightly, it can rub on the shroud when the release button is depressed. I suspect that the flange is sometimes bent down by careless and forceful removal of the take-up spool if the end of the spool catches on the flange.

References

The Leica-Type Shutter. S.L. Love. National Camera, Inc. Excellent explanation of how they work. Not much repair information. (This book and *The Leica IIIf* below are out of print but can be found online).

Focal Plane Shutters. http://www.pentax-manuals.com/manuals/service/focal%20plane%20shutters.pdf. Part of a Pentax manual. Excellent description of shutters with some valuable service information.

The Leica IIIf. Larry Lyells. National Camera, Inc. Superb repair text. Focuses on the IIIf but is useful for other models. Good information on out-of-camera curtain replacement and on a clever in-camera method in which portions of the old curtains and tapes are left in the camera.

Leica Camera Repair. Ed Romney. Romney Publishing. Basic repair text (nothing on shutter replacement) with many useful exploded diagrams of screw-mount Leicas through the IIIf.

Camera Disassembly for Shutter Adjustment, Repair, and Replacement. Jay Javier. http://jay.fedka.com/index_files/Page455.htm. Good article on Fed

cameras that is applicable to screw-mount Leicas. Shows the out-of-camera method.

Leica Repair Handbook. Tomas Tomosoy. Amherst Media, Inc. Useful basic repair and restoration tips. However, only 18 of 139 pages are specifically on screw-mount models.

Leica IIIf Servicing Instructions. Ernst Leitz GMBH. Promising title and publisher, but disappointing in its lack of shutter replacement information. Lots of IIIf diagrams. Many details on tensions, torques, dimensions, etc., but not very relevant to shutter replacement. This is a reprint of an old factory manual.

Canon Rangefinder Camera Service Manual and Parts List. Model IV-S2. Canon Camera Co, Inc. Similar to the Leica factory manual, but with more practical information.

The Leica Drum Shutter Tester. S.K. Grimes. http://www.skgrimes.com/idcc/. Details of a rotating drum tester that could be duplicated by the amateur.